

BEYOND EINSTEIN: From the Big Bang to Black Holes



Constellation

The Constellation X-Ray Mission

►► Upcoming Science Conferences of
interest to the Con-X FST

Presented by
Ann Hornschemeier
(GSFC)

Feb 15th FST Meeting
Royal Sonesta, Cambridge, MA



Thank you for a very successful Town Hall at the AAS!

*Photo gallery from the American Astronomical Society Meeting
(Constellation-X Booth & Town Hall Meeting)*



■ Constellation-X Booth:

- Hard X-ray Telescope mirror shell
- Off-Plane Gratings “Demo” with laser pointer
- Calorimeter samples

Future Con-X Graduate Student



Con-X Project Scientist Demonstrates Utility



Con-X Systems Engineers test performance



17 Constellation-X Science Posters (Session 16)

Black Holes and Strong Gravity:

- Miller, J. "Revealing Intermediate Mass Black Holes"
- Reynolds, C. "Probing strong gravity and extreme astrophysics around black holes"

Black Holes and the Growth of Structure:

- Bauer, F. E "The High Redshift Universe"
- Gallagher, S. C. "Cosmic Feedback: Constraining AGN Outflows"
- Levenson, N.A. "Present Observations of Obscured AGN and Future Prospects"
- Nicastro, F. "The Warm-Hot Intergalactic Medium"
- Schindhelm, E. "High resolution x-ray spectroscopic studies of AGN outflows"
- Strickland, D. "Starburst Galaxies with Constellation-X"

Dark Energy/Dark Matter:

- McNamara, B. R. "Studying Cosmic Feedback in Clusters"
- Rapetti, D. "Probing Dark Energy"
- Vikhlinin, A. "Cosmology with High-Redshift Galaxy Clusters"

Life Cycles of Matter:

- Drake, J. "High Energy Stellar and Protostellar Physics"
- Feigelson, E. "X-rays & Planet Formation"
- Hwang, U. "Constraining the Progenitors and Explosions of Supernova Remnants"
- Sanwal, D. "Neutron Star Equation of State"
- Schulz, N. "X-Ray Surveys of Interstellar Media"
- Smith, R. "High-Resolution Spectroscopy of the Diffuse ISM"

16 Con-X Technology Posters (Session 12)

Spectroscopy X-ray Telescope

- Zhang, W.W., "Lightweight X-ray Mirrors for the Constellation-X Mission"
- Reid, P.B., "Stray Light Shielding for Formation Flying X-ray Telescopes"

X-ray Microcalorimeter Spectrometer

- Eguchi, H., "Properties of Vapor-Deposited Au:Er Films for Metallic Magnetic Calorimeters"
- Irwin, K.D., "Multiplexed x-ray microcalorimeters with improved energy resolution for Constellation-X"
- Kelley, R., "Requirements, Goals and Challenges for an X-Ray Microcalorimeter Spectrometer on the Constellation-X Observatory"
- Kilbourne, C.A., "High-density arrays of x-ray microcalorimeters for Constellation-X"
- Porter, S.F., "The development of high resolution silicon x-ray microcalorimeters"
- Silver, E.H., "Advances in NTD Germanium-Based Microcalorimeters For Soft and Hard X-Ray Spectroscopy on Constellation X"

Hard X-ray Telescope

- Gorenstein, P., "The Con-X Hard X-Ray Telescope and its angular resolution"
- Hailey, C., "Segmented Glass Optics and the Hard X-ray Telescope on Constellation-X: Progress and Prospects"
- Romaine, S., "Development of Prototype Nickel Optic for the Constellation-X Hard X-Ray Telescope"

Reflection Grating Spectrometer

- Flanagan, K., "Highlights of Constellation-X Reflection Grating Spectrometer Technology Development"
- Heilmann, R., "Soft X-ray Reflection Grating Technology Development for Constellation-X"
- Seely, J.F., "Efficiency of a Grazing Incidence Off-Plane Grating in the Soft X-Ray Region"
- Ricker, G.R., "Event Driven X-ray CCD Detector Arrays for the Reflection Grating Spectrometer on the Constellation-X Mission"

Science Conferences June – July 2006

■ Summer AAS Meeting

- **Dates:** Sunday, 4 June 2006 - Thursday, 8 June 2006
- **Location:** Calgary, Alberta
- **Abstract Deadline:** March 23, 2006

■ “Variable and Broad Iron Lines around Black Holes” (XMM workshop)

- **Dates:** Monday 26th - Wednesday 28th June 2006
- **Location:** XMM-Newton Science Operations Centre, Madrid, Spain
- **FST/Panel Members on the SOC:** A. Fabian, G. Matt, J. Miller, C. Reynolds, J. Turner
- **Abstract deadline:** None posted yet, contact ws2006@sciops.esa.int

■ Physics and Astrophysics of Supermassive Black-Holes

- **Dates:** July 9 - July 14, 2006
- **Location:** Santa Fe, New Mexico
- **FST Invited Speakers:** Begelman*, Blandford, Fabian, C. Reynolds
- **Abstract deadline:** August 2005, visit <http://qso.lanl.gov/meetings/meet2006/>

Science Conferences July 2006 – Aug 2006

- **Astrophysics of Neutron Stars and Black Holes – Observations**
(11th Marcel Grossmann Meeting on General Relativity)

- **Date:** Sunday, 23 July 2006 - Saturday, 29 July 2006
- **Location:** Berlin, Germany
- **SOC Chair:** Norbert Schulz (MIT)
- **Invited speakers:** J. Bregman & D. Worrall
- **Topics include** “The Future of X-ray Spectroscopy”
- **Website:** <http://space.mit.edu/home/nss/mg11.html>
- **Abstract deadline:** May 15 2006

- **IAU Symposium No. 238: Black Holes -- from Stars to Galaxies**

- **Date** Monday, 21 August 2006 - Friday, 25 August 2006
- **Location** Prague, Czech Republic
- **Invited Speakers:** M. C. Begelman, A. C. Fabian, R. F. Mushotzky
- **SOC members:** Blandford, Fabian, **Matt — co-chair**, Yaqoob
- **Website:** <http://astro.cas.cz/iaus238>
- **Abstract deadline:** 15 May 2006

HEAD 2006

■ AAS HEAD

- **Dates:** Wednesday, 4 October 2006 - Saturday, 7 October 2006
- **Location:** San Francisco, California
- **Plans:** Con-X Wavelength Card

REVOLUTIONIZING HIGH SPECTRAL RESOLUTION STUDIES IN X-RAYS

He-like R, I_2 , I_1 , F lines from Drake 1988, Can. J. Physics 66, 586

El	R[w]	R[w]	$I_2[x]$	$I_2[x]$	$I_1[y]$	$I_1[y]$	F[z]	F[z]
	Å	keV	Å	keV	Å	keV	Å	keV
C	40.268	0.3079	40.729	0.3044	40.73	0.3044	41.472	0.2990
N	28.787	0.4307	29.082	0.4263	29.08	0.4264	29.534	0.4198
O	21.602	0.5739	21.801	0.5687	21.804	0.5686	22.101	0.5610
Ne	13.447	0.9220	13.550	0.9150	13.553	0.9148	3.698	0.9051
Na	11.003	1.1268	11.080	1.1190	11.083	1.1187	11.192	1.1078
Mg	9.169	1.3522	9.228	1.3435	9.231	1.3431	9.314	1.3311
Al	7.757	1.5983	7.804	1.5888	7.807	1.5881	7.872	1.5750
Si	6.648	1.8650	6.685	1.8547	6.688	1.8538	6.740	1.8395
S	5.039	2.4606	5.063	2.4488	5.066	2.4471	5.102	2.4303
Ar	3.949	3.1396	3.966	3.1262	3.969	3.1238	3.994	3.1043
Ca	3.177	3.9025	3.189	3.8879	3.193	3.8830	3.211	3.8612
Fe	1.851	6.7000	1.855	6.6823	1.859	6.6676	1.868	6.6365
Ni	1.588	7.8053	1.592	7.7865	1.597	7.7660	1.604	7.7316

CONSTELLATION - X



REVOLUTIONIZING HIGH SPECTRAL RESOLUTION STUDIES IN X-RAYS

Hydrogenic Ly α from Johnson & Soff 1985, ADNDT, 33, 405. Ly β lines from Ericson 1977, JPCRD, 6, 3

El	Ly α_1	Ly α_1	Ly α_2	Ly α_2	Ly β_1	Ly β_1	Ly β_2	Ly β_2
	Å	keV	Å	keV	Å	keV	Å	keV
C	33.734	0.3675	33.740	0.3675	28.465	0.436	28.466	0.436
N	24.779	0.5004	24.785	0.5002	20.909	0.593	20.911	0.593
O	18.967	0.6537	18.973	0.6535	16.006	0.775	16.007	0.775
Ne	12.132	1.0220	12.137	1.0215	10.238	1.211	10.240	1.211
Na	10.023	1.2370	10.029	1.2363	8.459	1.466	8.460	1.465
Mg	8.419	1.4726	8.425	1.4717	7.106	1.745	7.107	1.745
Al	7.171	1.7290	7.176	1.7277	6.089	2.036	6.091	2.036
Si	6.180	2.0061	6.186	2.0043	5.217	2.377	5.218	2.376
S	4.727	2.6227	4.733	2.6197	3.991	3.107	3.992	3.106
Ar	3.731	3.3230	3.737	3.3182	3.150	3.936	3.151	3.934
Ca	3.018	4.1075	3.024	4.1001	2.549	3.864	2.550	4.862
Fe	1.778	6.9732	1.783	6.9520	1.502	8.252	1.504	8.246
Ni	1.530	8.1017	1.536	8.0731	1.293	9.586	1.295	9.577

CONSTELLATION - X

If you attend a conference, please:

- Contact Ann Hornschemeier or Michael Garcia to let us know (annah@milkyway.gsfc.nasa.gov, garcia@cfa.harvard.edu)
- Remember that we have slides that we can provide to you
- We have a set of slides that are also available for a Constellation-X “lunch talk” if you would like to offer to give an extra talk when visiting other institutions for colloquia
- Thank you!